rotate the first cam around its axis; a second rotary cam for actuating the end pin, the second rotary cam being rotatably mounted to oppose to the first rotary cam; a driving engaging portion provided on a side surface of the first rotary cam opposing to the second rotary cam; a driven engaging portion provided on one side surface of the second rotary cam so as to be engaged by the driving engaging portion in accordance with the rotation of the first rotary cam; thereby, rotating the second rotary cam; and a rotation restricting projection provided on the other side surface of the second rotary cam, the rotation restricting projection being engageable with a stopper portion of the supporting member so as to hold the second rotary cam at a first stop position or at a second stop position; wherein the cam contour of the second rotary cam is such that the end pin projects from the display surface when the second rotary cam has been rotated to one of the stop positions as a result of the rotation of the shaft of the motor in one direction, and that the end pin is retracted from the display surface when the second rotary cam has been rotated to the other stop position as a result of the rotation of the shaft of the motor in the other direction.

The plurality of pins may include four pins, and the motor may be designed to hold the first rotary cam at one of eight step positions which are arranged at 45° intervals.

The motor may be a stepping motor.

When four pins are employed and a stepping motor is used as the actuator, the rotary motion of the motor shaft causes rotation of the first cam which is a triplet cam.

The triplet cam has a specific cam contour composed of concave and convex portions arranged in a specific pattern, so that rotation of the triplet cam urges associated ends of the braille pins so as to cause independent axial displacements of the pins. Consequently, the ends of the pins supported by the supporting member are selectively projected from and retracted behind the display surface, whereby three-bit binary information is available on the display surface.

When a fourth cam portion (i.e., the second rotary cam) is at one of the first and second stop positions, the stepping motor can perform seven steps at 45° intervals without causing rotation of the fourth cam portion (second rotary cam). Such is the case if the direction of rotation of the stepping motor shaft does not restrict the rotation of the fourth cam portion because the engaging portions on the first and second rotary cams do not engage with each other. Consequently, no change is caused in the status of the end pin (fourth pin) so that the fourth pin is kept in, for example, a projected position. It is thus possible to realize eight patterns of a combination of the pin status, with the fourth pin held in the projected state, out of the sixteen patterns which are obtainable with the four pins.

Similarly, when the fourth cam portion (i.e., the second rotary cam) is at the other of the stop positions, the stepping motor can perform seven steps at 45° intervals without causing rotation of the fourth cam portion (second rotary cam) if the direction of rotation of the stepping motor shaft such that it does not restrict the rotation of the fourth cam portion because the engaging portions on the first and second rotary cams do not engage with each other. Consequently, no change is caused in the status of the end pin (fourth pin) so that the fourth pin is kept in, for example, a retracted position. It is thus possible to realize another eight patterns of a combination of the pin status, with the fourth pin in the retracted state, out of the sixteen patterns which are obtainable with the four pins.

It is thus possible to represent sixteen different patterns of a combination of the status of the four pins (i.e., to display four-bit information) by a stepwise 45° incremental rotation of the shaft of the stepping motor.

Initialization of the stepping motor can be effected by causing, when the fourth cam is at one of the stop positions, the stepping motor to perform several steps in the direction in which the fourth cam is stopped. That is, the stepping of the motor in such a direction also causes the shaft of the stepping motor to be forcibly stopped because the driving engaging portion on the triplet cam connected to the motor shaft engages with the driven engaging portion on the fourth cam portion so as to be stopped by the latter. When the driving pulses of voltage are consecutively applied to the stepping motor in this state, the motor which is restrained from rotating is naturally brought out of the phase, so that the original relationship between the cam positions and the phase of the stepping motor is recovered, whereby the apparatus is reset to the initial condition.

These and other features and advantages of the present invention will become clear from the following description of the preferred embodiments when the same is read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a longitudinal sectional view of an embodiment of the binary information display apparatus of the present invention;

FIGS. **2**(*a*), **2**(*b*), **2**(*c*) and **2**(*d*) are illustrations of cam portions as viewed in the direction of an arrow X in FIG. **1**;

FIG. **3** is a schematic perspective view of a braille display apparatus incorporating the binary information display apparatus shown in FIG. **1**;

FIGS. **4**(*a*) to **4**(*i*), in combination, illustrate the positional relationship between the first cam portion and the fourth cam portion;

FIG. **5** is a flow chart showing the flow of control of a stepping motor; and

FIG. **6** is a vertical sectional view of a conventional braille display cell.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the present invention will be described in reference to the accompanying drawings.

FIG. **1** is a longitudinal sectional view of an embodiment of the binary information display apparatus of the present invention. FIGS. **2**(*a*), **2**(*b*), **2**(*c*) and **2**(*d*) are illustrations of cam portions **8**, **5**, **6**, **7** as viewed in the direction of an arrow X in FIG. **1**; and FIG. **3** is a schematic perspective view of a braille display apparatus incorporating the binary information display apparatus shown in FIG. **1**. FIGS. **4**(*a*) to **4**(*i*) are representations illustrative of the positional relationship between the first cam portion and the fourth cam portion.

In reference to FIGS. **1** and **2**, the binary information display apparatus of this embodiment is designed so as to display four-bit information, and has a plurality of parallel pins (four braille pins used in this case) **11**, **12**, **13**, **14**; a supporting member **2** which supports these pins **11**, **12**, **13**, **14** such that these pins are independently slidable in vertical directions; and an actuating mechanism **21** which acts on the lower ends of these pins **11**, **12**, **13**, **14** so as to urge these pins upward; thereby causing independent vertical movements of such pins.

The supporting member **2** also serves as a casing for mounting a later-mentioned stepping motor **3** which consti-